Shoreface morphodynamics in Ireland and France

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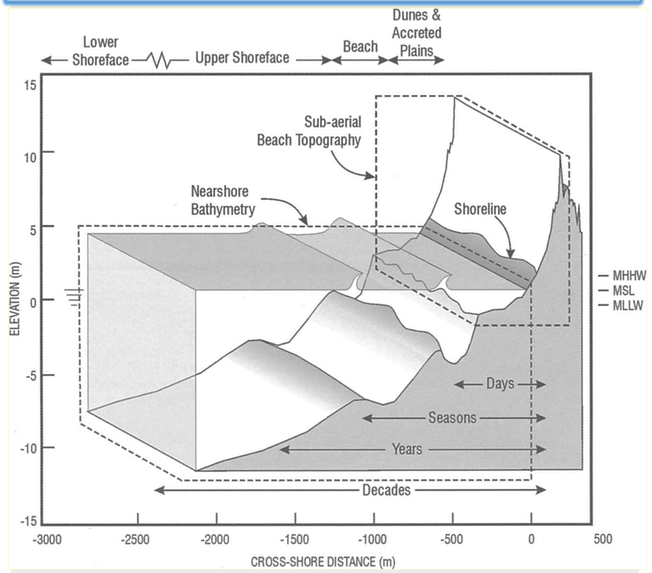
1. Introduction

The coastal and nearshore zones are environments in constant evolution, shaped by weather-wave interactions and at times vulnerable to high energy storm events as well as under threat given the current trend of climate change. The physical processes involved in coastal evolution are not yet fully understood. The sediment dynamics in these zones is difficult to describe especially in the submerged zone (shoreface) where the system is less accessible for hydrographic surveying. Currently, advances are still required to understand the role of the shoreface in the variability of the beach and shoreline. In this context, this study aims to advance our understanding of the morphodynamics of the shoreface in Ireland and France.

2. The shoreface



Definition of the shoreface from [1] Ruggiero et al., 2005.

Key facts about the shoreface:

- **Transition zone** between the surf zone and the inner shelve
- **Friction dominated** zone controlled by shoaling [2]
- Acts as both a sediment **source** and a sediment **sink**, as well as facilitator or inhibitor for sediment transport
    - onshore directed net sediment transport under lower wave height scenarios
    - during high energy conditions (i.e. storm, higher wave heights) net sediment transport is directed offshore

No significant bed change occur on the lower shoreface for time scales up to years, as indicated by yearly depth of closure calculations.

However, over longer time scales the rates of sediment transport on the shoreface can however have a significant impact on coastal dynamics [3,4].

3. The coast of Ireland and NW France

The coast of (west) Ireland and north-western France (Brittany) Is characterised by the **dominance of underlying geology** in the local geomorphology and landscape.

North-east Atlantic: high-energy with meso- to macro-tidal range, the geological framework seems to constrain contemporary morphodynamics.

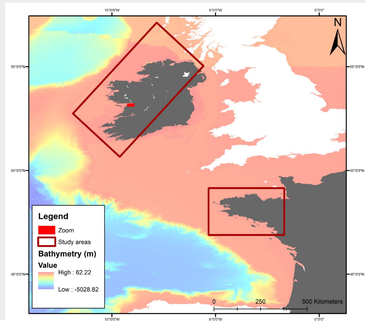
Fundamental principle of coastal dynamics, such as the principle of equilibrium profile, depth of closure or morphodynamic state appears invalid, as they stand, for rocky coasts [5,6,7] requiring a better understanding of this type of environment.

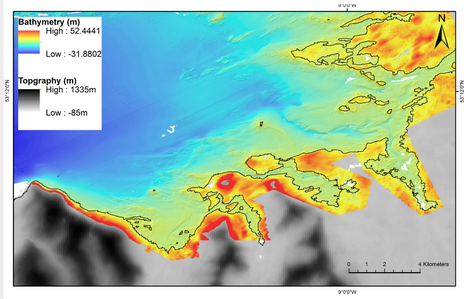
Consequences of rocky coasts on morphodynamics

The local geological setting has an influence on:

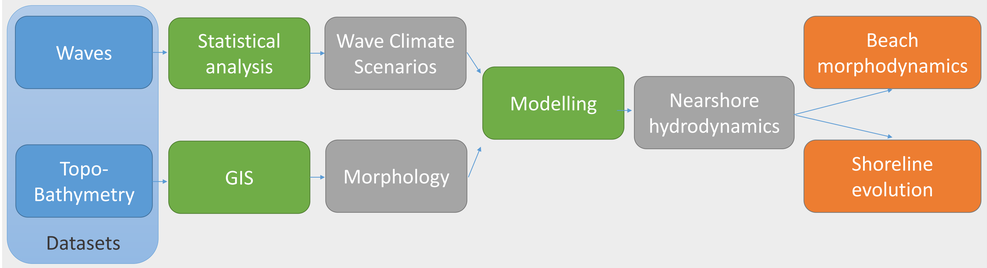
- Longshore sediment transport (disruption, by-pass)
- Nearshore currents
- Accommodation space
- Sediment type and size
- Sediment availability
- Modern sedimentary structures (e.g ridges, banks sorted bedforms)
- …

Localisation map and zoom on a the coast of Galway bay (as an example of the intricate rock dominated coast found in Ireland and Brittany)





4. Methods



With advances in remote sensing (e.g. multi-beam and airborne Lidar), spatially extensive **topo-bathymetry datasets** are more easily acquired. In association with temporally broad **wave data** (either *in-situ*, modelled or hindcasted) and along with **numerical modelling tools**, the understanding of the coastal zone and its associated processes is improving rapidly.

Various tools are to be used in order to determine wave climate scenarios and typical existing morphology (select representative study sites) to model nearshore hydrodynamics (using SWAN). Results will be analysed to for spatial variations and to examine shoreface morphodynamics and it's influence on the shoreline and beach.

5. Objectives

The overall aim of this investigation is to:

Advance our understanding of the morphodynamics of the shoreface in geologically complex regions such as the west of Ireland and north west France and examine its link to dune-beach system behaviour and shoreline evolution patterns

6. Perspectives

The specific goals to be met by this investigation are :

- Identify and assess the different existing **shoreface configurations** in Ireland and France, and evaluate for those configurations the morphological and sedimentary characteristics (e.g. slope, sediment budget etc.)
- Study **the hydrodynamic behaviour** operating over various shoreface configurations, particularly for the dissipation of incoming wave energy
- Identify and link **large scale spatial variations** in hydrodynamic behaviour of the shoreface, under different wave climate and regional settings
- Examine for each of the shoreface configurations, associated parallel nearshore settings and **link shoreface dynamic to shoreline-beach behaviour** for the different configurations
- Establish a 3D **shoreface morphodynamic classification**

Bibliography

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